WHAT IS CLAIMED IS:

1. A method of forming a peptide conjugate comprising a covalent linkage between a modifying group and a glycosylated or non-glycosylated peptide, wherein said modifying group is conjugated to the peptide via a glycosyl linking group interposed between and covalently linked to both said peptide and said modifying group, said method comprising:

a. contacting a cell with a modified sugar comprising a sugar moiety and at least one modifying group, wherein said modifying group is a member independently selected from the group consisting of a water-soluble polymer, a therapeutic moiety, a detectable label, a biomolecule and a targeting moiety;

b. incubating said cell under conditions in which said cell internalizes said modified sugar;

c. after step b, intracellularly contacting said modified sugar with a glycosylated or non-glycosylated peptide and a glycosyltransferase for which said modified sugar is a substrate, thereby forming said peptide conjugate.

2. The method of claim **1**, further comprising, after step b and before step c, intracellularly contacting said modified sugar with a nucleotide and a nucleotidyl transferase, thereby forming a modified nucleotide sugar, wherein

said modified sugar in step c is said modified nucleotide sugar.

3. The method of claim **1**, further comprising isolating said peptide conjugate.

4. The method of claim **1**, wherein said modified sugar is a modified nucleotide sugar.

5. The method of claim **1**, wherein said modified sugar is a modified activated sugar.

6. The method of claim **1**, wherein said glycosyl linking group is an intact glycosyl linking group.

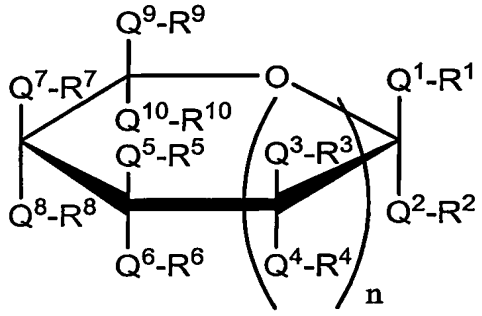
7. The method of claim 1, wherein said modified sugar is a precursor modified sugar that is intracellularly converted to an intermediate modified sugar by cellular enzymes after step b and before step c.

8. The method of claim 7, wherein said intermediate modified sugar is a phosphorylated modified sugar, wherein said phosphorylated modified sugar is formed by intracellularly contacting said modified sugar with a kinase for which said modified sugar is a substrate, thereby forming a phosphorylated modified nucleotide sugar.

9. The method of claim 1, wherein said water-soluble polymer comprises poly(ethylene glycol).

10. The method of claim 10, wherein said poly(ethylene glycol) has a molecular weight distribution that is essentially homodisperse.

11. The method of claim 1, wherein said modified sugar has the formula



(I)

wherein,

n represents an integer from 0 to 1;

Q^1, Q^2, Q^3, Q^4, Q^5, Q^6, Q^7, Q^8, Q^9, and Q^{10} are members independently selected from a bond, substituted or unsubstituted alkylene, substituted or unsubstituted heteroalkylene, substituted or unsubstituted cycloalkylene, substituted or unsubstituted heterocycloalkylene, substituted or unsubstituted arylene, substituted or unsubstituted heteroarylene, -O-, $-N(R^{1A})-$, -S-, -C(O)-, and $-CH_2-$, wherein

R^{1A} is a member selected from hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl,

substituted or unsubstituted aryl, and substituted or unsubstituted heteroaryl; and

R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} are members independently selected from $-OPO_3H_2$, -OH, $-NH_2$, -SH, hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, an activated leaving group, a nucleotidyl moiety, and a modifying group, wherein at least one of R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} is a modifying group.

12. The method of claim **11**, wherein

Q^1-R^1, Q^2-R^2, Q^3-R^3, Q^4-R^4, Q^5-R^5, Q^6-R^6, Q^7-R^7, Q^8-R^8, Q^9-R^9, and Q^{10}-R^{10} are members independently selected from hydrogen, $-OPO_3H_2$,-OH, $-OCH_3$, $-CH_3$, -C(O)H, $-CH_2OH$, $-NHR^{11}$, $-O-CH(CH_3)COOR^{12}$, $-C(O)OR^{13}$, $-CHR^{14}-CHR^{15}-CH_2R^{16}$, an activated leaving group, a nucleotidyl moiety and -L-M, wherein at least one of R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} is -L-M, wherein

L is a linker independently selected from a bond, substituted or unsubstituted alkylene, substituted or unsubstituted heteroalkylene, substituted or unsubstituted cycloalkylene, substituted or unsubstituted heterocycloalkylene, substituted or unsubstituted arylene, substituted or unsubstituted heteroarylene, -O-, -NH-, -S-, and CH_2-,

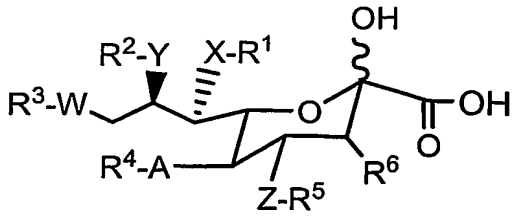
M is a modifying group, and

R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, and R^{16} are independently selected from hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, and $-L^1-M^1$, wherein

L^1 is a linker independently selected from a bond, substituted or unsubstituted alkylene, substituted or unsubstituted heteroalkylene, substituted or unsubstituted cycloalkylene, substituted or unsubstituted heterocycloalkylene, substituted or unsubstituted arylene, substituted or unsubstituted heteroarylene, –O-, -NH-, -S-, and CH_2-, and

M^1 is modifying group.

13. The method of claim 11, wherein said modified sugar has the formula



(II)

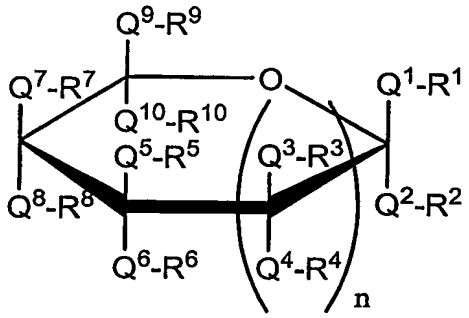
wherein,

W, X, Y, Z, and A are members independently selected from a bond, substituted or unsubstituted alkylene, substituted or unsubstituted heteroalkylene, substituted or unsubstituted cycloalkylene, substituted or unsubstituted heterocycloalkylene, substituted or unsubstituted arylene, substituted or unsubstituted heteroarylene, –O-, -N(R^7)-, -S-, and -CH_2-, wherein,

R^7 is a member independently selected from hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, and substituted or unsubstituted heteroaryl; and

R^1, R^2, R^3, R^4, R^5 and R^6 are members independently selected from -OH, -NH_2, -SH, hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, and a modifying group, wherein at least one or R^1, R^2, R^3, R^4, R^5 and R^6 is a modifying group.

14. The method of claim 4, wherein said modified nucleotide sugar has the formula



(I)

wherein,

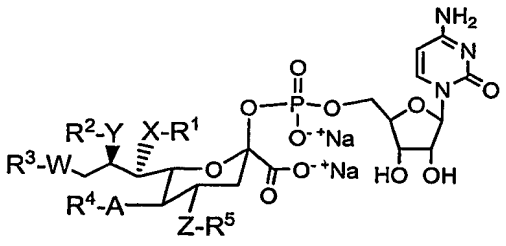
n represents an integer from 0 to 1;

Q^1, Q^2, Q^3, Q^4, Q^5, Q^6, Q^7, Q^8, Q^9, and Q^{10} are members independently selected from a bond, substituted or unsubstituted alkylene, substituted or unsubstituted heteroalkylene, substituted or unsubstituted cycloalkylene, substituted or unsubstituted heterocycloalkylene, substituted or unsubstituted arylene, substituted or unsubstituted heteroarylene, -O-, $-N(R^{1A})-$, -S-, -C(O)-, and $-CH_2-$, wherein

R^{1A} is a member selected from hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, and substituted or unsubstituted heteroaryl; and

R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} are members independently selected from $-OPO_3H_2$, -OH, $-NH_2$, -SH, hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, an activated leaving group, a nucleotidyl moiety, and a modifying group, wherein at least one of R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} is a modifying group and a nucleotidyl moiety.

15. The method of claim **14**, wherein said modified nucleotide sugar has the formula



(III)

wherein,

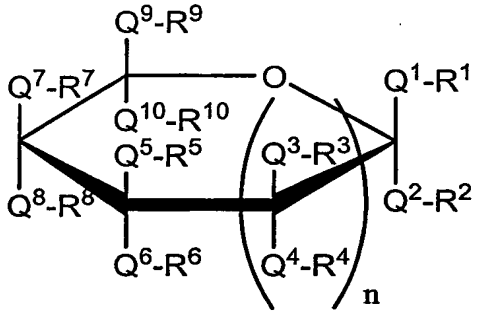
W, X, Y, Z, and A are members independently selected from a bond, substituted or unsubstituted alkylene, substituted or unsubstituted heteroalkylene, substituted or unsubstituted cycloalkylene, substituted or unsubstituted heterocycloalkylene, substituted or unsubstituted arylene,

substituted or unsubstituted heteroarylene, –O-, -N(R^7)-, -S-, and -CH_2-, wherein,

R^7 is a member independently selected from hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, and substituted or unsubstituted heteroaryl; and

R^1, R^2, R^3, R^4, and R^5 are independently selected from -OH, -NH_2, -SH, hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, and a modifying group, wherein at least one or R^1, R^2, R^3, R^4, and R^5 is a modifying group.

16. The method of claim **5**, wherein said modified nucleotide sugar has the formula



(I)

wherein,

n represents an integer from 0 to 1;

Q^1, Q^2, Q^3, Q^4, Q^5, Q^6, Q^7, Q^8, Q^9, and Q^{10} are members independently selected from a bond, substituted or unsubstituted alkylene, substituted or unsubstituted heteroalkylene, substituted or unsubstituted cycloalkylene, substituted or unsubstituted heterocycloalkylene, substituted or unsubstituted arylene, substituted or unsubstituted heteroarylene, -O-, -N(R^{1A})-, -S-, -C(O)-, and -CH_2-, wherein

R^{1A} is a member selected from hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl,

substituted or unsubstituted aryl, and substituted or unsubstituted heteroaryl; and

R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} are members independently selected from $-OPO_3H_2$, -OH, $-NH_2$, -SH, hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted heteroalkyl, substituted or unsubstituted cycloalkyl, substituted or unsubstituted heterocycloalkyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, an activated leaving group, a nucleotidyl moiety, and a modifying group, wherein at least one of R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, and R^{10} is a modifying group and an activated leaving group.

17. The method of claim **1**, wherein said peptide is selected from the group consisting of granulocyte colony stimulating factor, interferon-alpha, interferon-beta, Factor VIIa, Factor IX, follicle stimulating hormone, erythropoietin, granulocyte macrophage colony stimulating factor, interferon-gamma, alpha-1-protease inhibitor, glucocerebrosidase, tissue plasminogen activator protein, interleukin-2, Factor VIII, chimeric tumor necrosis factor receptor, urokinase, chimeric anti-glycoprotein IIb/IIIa antibody, chimeric anti-HER2 antibody, chimeric anti-respiratory syncytial virus antibody, chimeric anti-CD20 antibody, DNase, chimeric anti-tumor necrosis factor antibody, human insulin, hepatitis B sAg, interferon-omega, alpha-galactosidase A, alpha-iduronidase, anti-thrombin III, human chorionic gonadotropin, and human growth hormone.

18. A cell comprising a peptide conjugate, said peptide conjugate comprising:

(i) a modifying group and a peptide, wherein said modifying group is linked to said peptide via a glycosyl linking group interposed between and covalently linked to both the peptide and said modifying group; and

(ii) said modifying group is a member independently selected from the group consisting of a water-soluble polymer, a therapeutic moiety, a detectable label, and a targeting moiety.

19. The method of claim **18**, wherein said glycosyl linking group is an intact glycosyl linking group.